

38TH CONGRESS, }  
1st Session. }

SENATE.

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REPORT  
OF  
THE SUPERINTENDENT  
OF THE  
COAST SURVEY,  
SHOWING  
THE PROGRESS OF THE SURVEY  
DURING  
THE YEAR 1863.

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WASHINGTON:  
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1864.

# REPORT.

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COAST SURVEY OFFICE,  
*Washington, D. C., December 15, 1863.*

SIR: I have the honor to submit, in accordance with the law and regulations of the Treasury Department, my report for the surveying year ending November 1, 1863, and with it an engraved map showing the general progress of the work, and a manuscript map prepared at the office, in accordance with the act of Congress of March 3, 1853.

The survey has been in progress, in its field or office work, in all the States of the Atlantic and Pacific coast, upon the diminished scale of the previous year. The officers have been, as heretofore, detailed where they could render important service in the armies and fleets of the Union, and in reply to applications from the officers commanding, and of the departments. A condensed statement of the whole of the operations of the survey and its officers will be given in the prefatory chapter of the report, part I, and a more detailed statement in part II of the report.

The estimates for the next fiscal year are made to conform to those of the past, as having received the approval of the Treasury Department, of Congress, and of the Executive.

The policy of the department to press forward the survey on the more exposed portions of the coast, and in the rivers connected with the blockades, has been carefully followed up, and aid has been rendered by reconnaissance and other operations whenever the War Department or the Navy Department indicated that it was desirable. These subjects will be treated in detail, and some of the acknowledgments received will be produced as showing the incidental advantages of the survey, (Appendix No. 26.)

In the plan for conducting the survey, furnished by the act of Congress of March 3, 1843, the surveys of the rivers were required to extend as far as needed by commerce or defence. The importance of the military and naval operations upon the rivers has been fully developed by the war, and I have called the attention of the honorable Secretary of the Treasury to the matter. The letter of the Navy Department, with the applications of the distinguished admirals who serve in North Carolina, and on the Mississippi and its tributaries, has been an additional stimulus to this undertaking. The usefulness of the river maps of the survey, though their extent towards the sources was in many cases quite inadequate, has been acknowledged in the strongest terms by distinguished authorities and officers both of the military and naval service.

I should not omit to state that the officers of the survey have rendered other incidental services in regard to lights, beacons, and buoys on the coast, and to certain of the tax commissioners of the Treasury Department.

The regular operations have, meanwhile, been assiduously carried on, making the estimated progress in the Eastern and Middle States, and also at the South, wherever adequate protection could be had from our military or naval forces, or such protection was not needed.

The Superintendent of the Coast Survey has continued to serve on the Light-house Board, in the permanent commission of the Navy Department, to whom inventions submitted to the department are referred; and has served also upon several committees of the National Academy of Sciences, whose services have been asked by the departments of the government, as upon the Committee on Weights and Measures, and on correcting compasses of iron or iron-clad vessels-of-war. Other officers of the survey have in this connexion rendered similar services.

The maps compiled at the Coast Survey Office for illustrating the movements of the war have been kept up to date, and their sale has reimbursed us for the gratuitous supply to officers of the army and navy, and of the government generally.

I must earnestly commend the officers of the Coast Survey who have thrown themselves into dangerous service at the call of their country, and have yielded effective service in surveys and reconnaissances, and in cases of exigency in engineering. They have already received the commendation of those in whose regular duties and services they have assisted as volunteers. The city of Philadelphia, in the time of supposed danger, was indebted to several of the officers for ready, zealous, and disinterested service, the value of which, had not the gallantry of our army relieved the city by distant operations, would have been inestimable, and which, in fact, was so termed at the time by the general in immediate command.

#### DIVISION OF THE REPORT.

Of the report, the first part or introduction contains a general summary of the progress of the year, the estimates for the next fiscal year, and generally remarks on portions of the field and office work of particular interest.

The second division of the report describes, under the heads of sections, the work done in each, its character, the persons and vessels employed, and the particulars of each survey. This part is closed by a chapter stating in a general way the character of work done in the office.

The Appendix contains generalized lists of the surveys of the year, of the developments in hydrography, and special lists showing the details of work in the office. Besides these, are included in it articles of scientific import. The items are classed under different heads, and the title of each given under its proper heading in a separate index.

An abstract of the contents of the report and an alphabetical index are given as usual.

#### GENERAL STATEMENT OF PROGRESS.

The general progress made in the survey is shown by the sketch, No. 29, which accompanies this report. The progress of the present year in field and office work will be here presented in a condensed form, the statements in detail being given in the second part of the report as heretofore.

In the northern sections of the Atlantic coast the regular work of triangulation has been carried on, reaching from Machias into Passamaquoddy bay, on the coast of Maine, under Sub-Assistant Webber; from Blue Hill bay towards Mt. Desert, by Assistant Fairfield; and above the mouth of Penobscot river, by Assistant McCorkle. For the connexion of primary bases, it has been continued by my own party on the coast of Connecticut; additional work to connect with it has been done by Assistant Blunt, east of the Hudson; and the verification work, on the coast of New Jersey, has been extended to the vicinity of Manasquam inlet, by Assistant Farley.

The detailed topography of Eastport harbor has been prosecuted by Sub-Assistant Dennis; that of the coast of Maine, from Winter harbor eastward, by Sub-Assistant Rockwell, but discontinued to meet the call for service near Chattanooga, Tennessee. The topography of the western side of the entrance, and that of the western shore of Penobscot bay, near Camden, by Sub-Assistants Ferguson and Dorr; that of the passages between the Sheepscot and Kennebec rivers has been nearly completed by Sub-Assistant Iardella, and the detailed survey of the vicinity of Harpswell Neck, Maine, continued by Assistant Longfellow.

Assistant Harrison has extended the triangulation required, and continued the plane-table survey of Narraganset bay. The shore-line survey of the Hudson river has been completed by work between Coxsackie and New Baltimore, by the party of Messrs. Harding and Strausz, and repeated examinations have been made of Sandy Hook and its vicinity for physical changes, by Assistants Whiting and Mitchell.

The hydrography of the year in the northern sections has embraced additional lines of deep-sea soundings, and the development of rocks and ledges near Portland entrance, and off the coast of Maine, by Lieut. Commander Phelps, with the steamer Corwin; that of Rockland harbor, by Assistant Edwards, (now in similar service at Charleston bar, S. C.); the in-shore hydrography, which includes the approaches to Muscongus bay and Penobscot bay, (western approach,) by Acting Assistant Cordell, with the steamer Vixen; that of the northern part of Casco bay, by Assistant Gerdes; that of the Hudson river, completed by the party of Messrs. Harding and Strausz; a development of ledges off the eastern end of Long island, and re-examination of part of New York harbor for the pilot commissioners, by Lieut. Commander Phelps; one near the Delaware breakwater, for the engineer department, by Capt. Patterson, hydrographic inspector

of the Coast Survey; and soundings off the coast of Maryland, and completion of the hydrography of the Potomac river, by Lieut. Commander Phelps.

Under directions of the Boston harbor commissioners, Assistant Mitchell has continued the observations of tides and currents in South bay and Fort Point channel, and in the outlets of the Charles and Mystic rivers.

As during the year previous more than the customary number of parties has worked this season on the coast of New England and that of the Middle States, all of them having been on duty in the earlier part of the year, with but two exceptions, either in the sections of the coast now under blockade, or in surveys for the use of the armies of the Union. One of the parties not so engaged was employed in the survey of Sandy Hook. The other had assisted in the survey of the Potomac, within the present fiscal year, for the Navy Department.

The several examinations made during the year at Sandy Hook are to keep in view the important changes going on there, and which may develop into dangerous circumstances. These surveys have been furnished to the engineer department, the operations of which keep steadily in contact with the changes from time to time going on. Services having a bearing on defensive purposes, rendered to that department by three of the assistants of the Coast Survey while working this season on the coast of Maine, have been acknowledged in communications addressed to me by the chief engineer.

The regular work has gone forward on the Pacific coast of the United States, though on a scale somewhat reduced by the peculiar circumstances of the currency there.

On the Atlantic and Gulf coasts, of nineteen assistants, fourteen sub-assistants, and twenty-two aids engaged in field-work or in hydrography, twelve assistants, seven sub-assistants, and ten aids have rendered service in connexion with military and naval operations, and most of those who have so co-operated have also been employed in duty on parts of the coast where the regular operations of the survey have been advanced during the latter part of the season.

The work done in the vicinity of the capital, and along the southern coast, having been performed under the immediate orders of military or naval authorities, will be briefly reviewed under a separate head.

#### SERVICE WITH THE ARMY AND NAVY.

Of the surveys which were steadily carried on in the vicinity of Washington city until the end of June, that of the banks of the Potomac near Alexandria, though specially ordered for purposes of defence, and executed by Assistant Harrison, combines with the regular work of the survey, as does also the triangulation of the river between Alexandria and Georgetown by Sub-Assistant Boyd. The topography of the eastern approaches to the District of Columbia has been extended by Assistant Adams, Sub-Assistant Ferguson, and Mr. Donn, and the survey near Fort Lyon by Assistant C. M. Bache. Sub-Assistant Boyd made a triangulation, and Mr. Donn took up the topography of the approaches to Baltimore, in the latter part of June, at the special call of the authorities charged with the defences of that city. This work has been suspended within a few days by the emergency which requires topographical service near Chattanooga, but will be completed as soon as practicable, as will also the plane-table surveys in the neighborhood of Washington. The heights of all the field-works near the capital have been determined and furnished to the chief engineer of defences.

The services at Port Royal and at the mouths of the Mississippi, referred to in my last report, have been followed up this year in the military department of North Carolina; on the coast of South Carolina and Georgia, particularly near Charleston, and at Tybee and Wassaw; in Louisiana, west of the Mississippi; and in the Mississippi and Yazoo rivers, during the sieges of Vicksburg and Port Hudson. In the first-named department, besides the triangulation of part of Neuse river by Assistant Fairfield, reconnaissance maps were made by Assistant West and Sub-Assistant Rockwell, while the enemy threatened Newbern and Little Washington. Charleston bar was surveyed by night, and lighted and buoyed by Assistant Boutelle with the steamer Bibb, just previous to the naval attack of April last. Port Royal bar was resurveyed by his party, and the buoys needed there and at the other entrances on the coast of South Carolina and Georgia were set, and have been properly marked on the charts which are supplied from the office for the blockading squadron. A hydrographic reconnaissance was made by the Bibb, in December, of the channel into Winyah bay, under the orders of Admiral DuPont. In returning from duty at the same station, in February, the Bibb took in tow one of the steam transports of General Foster, which had burst her boilers within twenty miles of the hostile shore, and delivered the vessel at Hilton Head. Mr. Boutelle also accompanied the

engineer of the Light-house Board for determining the aids to navigation needed for the naval service between Port Royal and St. John's river, Florida.

Assistant Edwards, in this section, sounded out two important branches of the inland passage between St. Helena and Port Royal sounds; examined the channels into Tybee roads; and pushed the hydrography of Wassaw sound, for which shore-line was furnished by a party under Sub-Assistant Dennis. Mr. Talcott, of the topographical party, narrowly escaped capture while working on Little Tybee island.

Six parties were actively and constantly engaged during an average period of about six months of the present surveying year on the coast of North Carolina, South Carolina, and Georgia, and their labors are warmly commended in communications to me from Major General Foster and Admiral DuPont.

At the request of the tax commissioners of Florida, one of the most active of the Coast Survey topographers was assigned to serve under their orders at Fernandina and St. Augustine. His services during the ensuing winter were prospectively called for by the commissioners, but, under a pressing call received from Chattanooga, within a few days, he has been assigned to topographical duty for the army of Major General Rosecrans. Three others, Assistant West, Sub-Assistant Rockwell, and Mr. Donn, are under orders for duty there, in compliance with the application.

Sub-Assistant Dorr, while in service with the tax commissioners, supervised the erection of additional earthworks at Jacksonville, Florida, when that place was reoccupied by the government forces in March last.

Under the protection afforded in the vicinity of Admiral Bailey's blockading vessels, the hydrography outside of the Florida keys has been completed within the year by a party under Acting Assistant Cordell, with the steamer Vixen. The same party sounded the main entrance and approach of Charlotte harbor. Both these surveys are in continuation of previous work, and fall into place with the regular progress of the Coast Survey.

In connexion with the military and naval operations on the Mississippi river and in Louisiana, three topographers have served with the army of Major General Banks, (Assistant Oltmanns, Sub-Assistant Hosmer, and Mr. Lyman,) and two, Sub-Assistant Fendall and Mr. Strausz, under the direction of Assistant Gerdes, with the fleet of Admiral Porter, and subsequently with the army of Major General Grant. A minute topographical survey of the west bank of the Mississippi opposite to New Orleans for defensive purposes; reconnaissance maps of the middle districts of Louisiana and of the Red river as far up as Alexandria; the topography of the approaches to Vicksburg while the siege was in progress, and the survey of those of Port Hudson after the surrender of that post, are part of the results of their labors.

The high terms of approval used by Admiral Porter in reviewing the arduous duties and progress of the parties assigned to service with his fleet have induced me to renew the surveying force on the Mississippi during the coming season. Both of the topographers before assigned kept the field until entirely disabled by sickness in the latter part of July, after the surrender of Vicksburg. Their work had been repeatedly pushed forward in the presence of the enemy, as was also that of the parties with the army of General Banks. Assistant Oltmanns, on reconnaissance duty before Port Hudson, had his horse killed by a rebel shot, and previously, himself and Mr. Lyman being on board of the gunboat Kinsman, were in imminent peril when that vessel snagged and went down in the Atchafalaya with a number of the soldiers on board. Mr. Oltmanns has continued in service in the military department of the Gulf during the entire year. Mr. Hosmer, having closed surveying duty assigned at the north, has been reassigned to service with the army of General Banks. These and similar arrangements are detailed in my report, together with the changes in disposition in the transfer of officers of the survey from the east and north to the south. The transfers are also shown by lists in the Appendix, Nos. 27 and 28. The minute survey of the approaches to the defensive works near St. Louis, and of the ground which they occupy, has been completed, and the sheet turned in, by Assistant R. M. Bache.

During the invasion of the State of Pennsylvania last summer, and in view of the possible danger of the city of Philadelphia, I volunteered my services, under your authority, to the governor of Pennsylvania, and, by his request, was associated with the military and civil authorities in charge of the defences, as chief engineer. The exigency was pressing, as was proved by the efforts to procure regular engineers for this work, and by the failure even to obtain officers for consultation. The character of my association, first with Major General Dana, and, since August, with Major General Cadwalader, in command of the post of Philadelphia, was such as to add a relish to the labor. The circumstances of alarm, too, occasioned by the progress of the enemy, though soon passed, were attested most substantially by the number of volunteers for active service from the citizens, even the reverend clergy taking part, enthusiastically, for their home defence;

retired officers of the regular army and of the volunteers came forward with officers of the Coast Survey, those of the railroads centring at Philadelphia, officers and members of the municipal bodies of the city, and graduates of the institutions of learning.

The surveys made under my immediate direction for the defences of Philadelphia have occupied Assistants H. L. Whiting, George Davidson, R. M. Bache, and C. M. Bache, and at the outset of the work, Assistants C. O. Boutelle and P. C. F. West, the last-named having been just previously in military service with the division of General W. F. Smith, at Carlisle, Pennsylvania; Sub-Assistants R. E. Halter, Cleveland Rockwell, and J. S. Bradford, also assisted in the work.

Having occasion to discuss the river maps extending to tide-water with one of the generals-in-chief of our armies, I received the gratifying assurance that he could not have arranged the plans for the operations of the army without the use of those maps. This strong expression was coincided in by an admiral of high distinction then engaged in the interior of several adjacent States. I would propose to make this network of the rivers more complete by passing above tide-water, and by the help of observations of latitude and of telegraphic longitudes, effected partly in past years, to lay the basis for a connected map.

During the progress of the year new and highly gratifying testimonials have been spontaneously rendered by officers in the military and naval service to the value of the maps, charts, and memoirs prepared by the Coast Survey, in facilitating the important operations with which they have been charged. Naval commanders have pronounced these aids to be invaluable in promoting the efficiency of the blockade and in securing the safety of the blockading vessels; and the commanders of military departments and generals in the field have, directly and through their engineer officers, repeatedly expressed to the Superintendent their high sense of the usefulness to their commands of the maps of their several fields of operations, which have been prepared at the office of the survey. Besides the regular publications of the survey, maps of the localities of the different expeditions, sieges, &c., have been prepared for popular use.

The operations just mentioned have been executed by the civilians of the Coast Survey; all of the naval officers but one, and all the army officers, having been detached from service with us.

As during last year the means of usefulness, and not the opportunities, have limited the range of our parties.

No losses of vessels or other property, excepting by ordinary wear, have been encountered during the year. The two vessels seized at Charleston in the winter of 1860-'61 have, however, been destroyed; the schooner *Petrel* by a broadside from the United States frigate *St. Lawrence*, and the tender *Fire Fly* by fire at Savannah.

#### OFFICE-WORK.

The details of the work of the year in the computing, drawing, engraving, photographing, lithographing, and electrotyping divisions of the office are given in Appendix No. 14. I append here merely the titles of the maps, charts, and sketches that have been completed, or were in progress during the year.

SECTION I. The engraving of Portland harbor, as a finished chart, has been completed; the drawing and engraving of preliminary charts of Dutch Island harbor, Bristol harbor, and Coaster's harbor, (Narraganset bay,) have been completed. Progress has been made in the drawing and engraving of the chart of Kennebec and Sheepscot rivers, Maine, and of coast charts No. 7, Muscongus bay to Portland, Maine; No. 8, Seguin island to Kennebunkport, Maine; No. 10, Cape Ann to Plymouth, Massachusetts; and No. 11, Plymouth to Hyannis, Massachusetts. The engraving of coast chart No. 9, Cape Neddick to Cape Ann, Massachusetts, and of Barnstable harbor, as a finished map, has been continued; the drawing of Rockland harbor, Maine, has been commenced; additions have been made to preliminary coast chart No. 3, Cape Small Point to Cape Cod, and to the progress sketches of the section; and a new progress sketch, showing the primary triangulation and the connexion of the base lines in Sections I and II, has been drawn and engraved.

SECTION II. Sheet No. II, of a general chart of the Atlantic coast of the United States, scale 1:1,200,000, Nantucket to Cape Hatteras, has been drawn and engraved; the engraving of the outlines and hydrography of coast chart No. 21, New York bay and harbor, (resurvey,) has been completed, and that of the topography of the same has been commenced; the drawing and engraving of the chart of Hudson river, sheet No. 2, Haverstraw to Poughkeepsie, and No. 3, Poughkeepsie to Glasco, in a preliminary form, have been completed; that of Hudson river, No. 1, New York to Haverstraw, as a finished map, has been continued; a hydrographic sketch of Phelps's ledge and Great Eastern rock, off Montauk Point, has been engraved, and additions have been made to the progress sketches of the section.

SECTION III. The engraving of general coast chart No. IV, Cape May to Cape Henry, as a preliminary chart; of coast chart No. 36, Chesapeake entrance, as a finished chart, and of Rappahannock river, (sheet No. 5,) from Occupacia creek to Punch Bowl, has been completed. The drawing and engraving of preliminary charts of Metomkin inlet, Virginia, and of Potomac river, sheet No. 1, from the entrance upward to Piney Point; No. 2, Piney Point to Lower Cedar Point; No. 3, Lower Cedar Point to Indian Head, have been completed. Progress has been made in the drawing and engraving of Potomac river, No. 4, Indian Head to Chain Bridge. The engraving of coast chart No. 29, sea-coast of Maryland and Virginia, and of Hampton Roads and Elizabeth river, Virginia, has been commenced. Additions have been made to the progress sketch of the section. A preliminary edition of the chart of Potomac river, sheet No. 4, Indian Head to Chain Bridge, and a military map of southeastern Virginia, have been engraved on stone, and considerable additions have been made to the general map of Virginia in colors.

SECTION IV. The drawing and engraving of preliminary charts of Hatteras inlet and Oregon inlet, North Carolina, have been completed. Progress has been made in the engraving of coast chart No. 37, Cape Henry to Currituck sound. The drawing of coast chart No. 47, Bogue inlet to Barren inlet, North Carolina, has been continued, and the engraving of the same and that of coast chart No. 48, Barren inlet to Lockwood's Folly inlet, embracing Cape Fear and approaches, has been commenced. A lithographic edition of the latter, in a preliminary form, and also of general coast chart No. V, Chesapeake entrance to Ocracoke inlet, have been produced for the use of the North Atlantic blockading squadron, Admiral S. P. Lee; and a map of the mountain region of North Carolina and Tennessee, including also parts of the States of Virginia, Kentucky, Alabama, Georgia, and South Carolina, has been drawn and engraved on stone for the use of the armies in the field.

SECTION V. The drawing and engraving of sheet No. III, of a general chart of the Atlantic coast, Cape Hatteras to Mosquito inlet, and of Calibogue sound and Skull creek, forming the inland passage between Tybee roads and Port Royal sound, as a preliminary chart, have been completed. The drawing of coast chart No. 53, Rattlesnake shoals to St. Helena sound, has been continued, and the engraving of the same commenced. Progress has been made in the drawing and engraving of the chart of Port Royal sound, with Beaufort, Broad and Chechessee rivers, and of Wassaw sound. A map of the coast region of South Carolina and Georgia, from Bull's bay to Ossabaw sound, and a map of James's island and Stono river, have been engraved on stone, and a map and chart of Charleston harbor has been lithographed on the scale of the original surveys for use in the siege operations.

SECTION VI. The drawing and engraving of general coast chart No. X, Straits of Florida, and of coast chart No. 71, Newfound Harbor key to Boca Grande key, have been completed. The drawing, sheet No. IV, of a general chart of the Atlantic coast, Mosquito inlet to Key West, including Bahama banks and Straits of Florida, has been completed, and the engraving of the same commenced. A new edition of the chart of Key West harbor, with improved sailing directions, has been lithographed, and the preliminary chart of the northeastern part of the Gulf of Mexico, in two sheets, (scale  $\frac{1}{800000}$ ), has been engraved on stone.

SECTIONS VII, VIII, IX. The engraving of a preliminary chart of the Southwest Pass of the Mississippi river has been completed, and that of coast chart No. 93, Lakes Borgne and Pontchartrain, has been executed as far as the field-work is completed. The drawing of Gulf coast chart, from Key West to the Rio Grande, has been completed, and the engraving of the same has been commenced. Progress has been made in the drawing of general coast chart No. XIV, Choctawhatchee bay to the Mississippi delta, and in the engraving of coast chart No. 100, Atchafalaya bay, and Côte Blanche bay. The preliminary chart of the northwestern part of the Gulf of Mexico in two sheets, (scale  $\frac{1}{800000}$ ), has been engraved on stone. A map of the vicinity of St. Louis and its military defences, on a large scale, has been drawn, and maps of parts of Louisiana and Mississippi, showing the fields of military operations in those States, have been lithographed.

SECTION X. The drawing and engraving of charts of the upper part of San Francisco bay; of the Pacific coast from Point Pinos to Bodega Head; and of Bodega bay, as preliminary charts, have been completed. The engraving of San Pablo bay, as a finished chart, has been completed. Progress has been made in the drawing and engraving of charts of Tomales bay and Drake's bay, as finished charts. Additions have been made to plates of charts previously engraved, and to the progress sketches of the section, and a hydrographic sketch of the Fanny shoal has been published.

SECTION XI. The drawing and engraving of a chart of the entrance to Koos bay, Oregon, have been completed, and the entrance to Gray's harbor, Washington Territory, has been drawn and engraved as a preliminary chart.

## MAPS AND CHARTS.

The maps and charts published by the Coast Survey Office, as has been explained in several of my previous reports, are of two general descriptions, which may be distinguished as *preliminary* and *finished*. The preliminary charts are those which are issued as soon after the several surveys as is consistent with accuracy of general delineation, and are designed to supply the immediate and pressing demands of navigation. The finished charts embody *all* the information furnished by the survey, including the minutest details, and embrace not only the hydrography, but the topography likewise. The two classes of charts differ in regard to the amount of the information which they furnish, but not in regard to the correctness of that which is given.

The charts are various in character, according to the objects which they are designed to serve. The most important distinctions are the following:

1. *General charts of the coast*, on a scale of  $\frac{1}{400000}$ , for off-shore navigation. These represent the shore-line, and in its characteristic features, so as to be readily recognized by the navigator approaching it. The entire Atlantic and Gulf coasts will be comprehended in sixteen charts of this class.

2. *Preliminary sea-coast charts*, on a scale of  $\frac{1}{200000}$ , for in-shore navigation. These will all be ultimately superseded by the more complete charts next to be named.

3. *Coast charts* for in shore navigation, on a scale of  $\frac{1}{80000}$ , exhibiting with minute accuracy every natural and every permanent artificial feature, above or below the water, which can be introduced without occasioning confusion. They exhibit, also, the topography for some distance from the shore.

4. *Charts of harbors, bays, anchorages, &c.*, on various scales adapted to the subject; also, sketches of local dangers, &c.

To the above there has been added, during the present year, upon the request of the Superintendent of the Naval Observatory, a series of *sailing charts*, upon a scale of  $\frac{1}{120000}$ , embracing the largest area of any, and designed to enable the navigator to protract his course. Four of these embrace the entire Atlantic coast of the United States, with the adjacent British possessions, for the delineation of which the British admiralty charts have been made use of. The Gulf coast is contained on two similar sheets. The surveys being still incomplete in some localities, the present edition of these charts, all of which are appended to this report, is necessarily a preliminary one. (Sketches Nos. 18—23.)

A like series for the Pacific coast, on the same scale, in three sheets, has been published since 1855, under the title of "Reconnaissance of the Western Coast."

The whole number of charts which have been engraved upon copper for publication, and which are now in use, is three hundred and twenty-six. This is exclusive of twenty-four copper plates containing the progress sketches, and thirty-five plates of diagrams.

Seventy-five sheets have been worked upon in the drawing division during the year ending October 31, 1863. Of this number five are the sailing charts above spoken of; three are general, or off-shore charts; two, preliminary sea-coast charts; eight, finished coast maps and charts; twenty-six, harbor charts; twenty, sketches; two, sheets of diagrams; nine, maps and sketches for engraving on stone, or for lithographic transfer. Fifty-four sheets have been completed, and twenty-one are in progress. Of those completed, six are finished harbor charts, and the others preliminary charts and sketches.

In the engraving division six first class maps and charts have been completed within the year, and nine plates of second class charts and sketches, exclusive of three diagrams. Preliminary editions of eleven, in outline and hydrography, preparatory to their final completion, have also been engraved. Thirty-three plates are now in progress, of which twelve were commenced within the present year.

This gives a total of eighteen plates completed, and thirty-three in progress, or of fifty-one plates worked upon during the year. There are, besides, in the division, seven plates in various stages of forwardness that have received no additions during the year, having already received all the material which the field-work has yet furnished.

In the lithographic division twenty-four maps or charts have been engraved or drawn upon stone; considerable additions have been made to others previously lithographed, and fifty-nine transfers for lithographic printing have been made from engravings or lithograph drawings.

All the details in regard to the production and distribution of maps and charts will be found in the report of the assistant in charge of the office. (Appendix No. 14.)

The following list contains the titles of the maps, charts, and sketches, the material for which is in the office, and which are intended to accompany this report, with the exception of such of their number as the

public interest may still require to be withheld from general issue at the time of its publication. They are arranged in geographical order, as usual, and marked with numbers corresponding to the numbers in the margin of the list.

- 1.—A. Progress sketch, Section I, primary triangulation.
- 2.—A bis. Progress sketch, Section I, upper sheet, coast of Maine.
- 3.— Rockland harbor, Maine.
- 4.— Casco bay, Maine.
- 5.— Boston harbor, resurvey of 1862.
- 6.— Nantucket shoals, new edition.
- 7.— Phelps's ledge and Great Eastern rock, off Montauk Point.
- 8.— Hudson river, from New York to Haverstraw.
- 9.— Hudson river, from Poughkeepsie to Troy.
- 10.—C. Progress sketch, Section III, Chesapeake bay and estuaries.
- 11.— Beaufort harbor, North Carolina, resurvey.
- 12.— Port Royal entrance, South Carolina, resurvey of 1863.
- 13.—F. Progress sketch, Section VI, Florida keys.
- 14.— Straits of Florida, general coast chart No. X.
- 15.— Florida keys, from the Elbow to Lower Matecumbe key, coast chart No. 69.
- 16.— Florida reefs, from Long key to Newfound Harbor key, coast chart No. 70.
- 17.— Western end of Florida reefs, including Tortugas keys.
- 18.— Atlantic coast, No. I, Cape Sable to Sandy Hook.
- 19.— Atlantic coast, No. II, Nantucket to Cape Hatteras.
- 20.— Atlantic coast, No. III, Cape Hatteras to Mosquito inlet.
- 21.— Atlantic coast, No. IV, Mosquito inlet to Key West.
- 22.— Gulf coast, eastern part, Key West to Mississippi river.
- 23.— Gulf coast, western part, Mississippi river to Rio Grande.
- 24.—J. Progress sketch, Section X, coast of California.
- 25.— Halfmoon bay, California.
- 26.— San Pablo bay, California.
- 27.— Tomales bay, California.
- 28.— Washington sound, Washington Territory, (new edition.)
- 29.— General progress sketch for 1863.
- 30.— Diagrams illustrating discussion of magnetic observations at Girard College.

#### DISTRIBUTION OF MAPS AND ANNUAL REPORTS.

During the year there has been a total distribution of volumes of the reports on the Coast Survey, amounting to 6,124 copies. This embraces reports of all years from 1851 to 1861, inclusive. A limited foreign distribution has been made of the volumes for 1859 and 1860, through the Smithsonian Institution. The total number thus sent abroad amounts to 333 for each year. It is proper to remark, in making this statement, that the maps and sketches originally designed to be appended to the volumes mentioned, in so far as they relate to portions of the coast under blockade, have been withheld from the copies distributed.

There remain on hand at present, of the report for 1861, only 137 copies; of that for 1855, 344 copies; and of that for 1857, 252 copies. Of the reports for other years the numbers exceed five hundred each, and for the last three years are upwards of two thousand.

During the year there have been distributed to libraries and other permanent institutions in different parts of the United States more than fifty copies of the volumes, of which the impressions are now most nearly exhausted, in order to complete sets which may be accessible to the public, at as many convenient points of the country as possible.

Of maps, charts, and sketches, about forty-six thousand have been distributed within the year. In this aggregate are embraced not only the publications strictly nautical, but also those maps and sketches of portions of the coast, and occasionally of the interior, as were likely to promote the successful prosecution of the important operations in which the navy and armies of the country have been engaged.

The details in regard to the distribution of reports, maps, charts, etc., will be found in the report from the miscellaneous division of the office. (Appendix No. 14.)

## ESTIMATES FOR THE FISCAL YEAR 1864-'65.

The estimates for the present fiscal year, to which the appropriations corresponded, were much diminished from those of 1860-'61 and 1861-'62, being \$306,000 for all the branches of service on the Atlantic, Gulf, and Pacific coasts. The estimates now submitted agree with the sums appropriated last year, and will enable us to continue the field and office work on the same reduced scale; to keep up the organization of our trained officers in field and office operations; to put into practical form, for the use of the departments and officers of the government, the information already collected; to continue the office compilations for use by the fleets, armies, and expeditions, and the publication of such maps as general public interests may render desirable or expedient, and to provide for the assignment of special parties, as heretofore, with your concurrence, when such parties can be useful, as the experience of the past two years shows they have been, in service with the fleets and armies.

The estimates for progress on the Atlantic, Gulf coast, Florida reefs, and western coast of the United States, are given as usual, in separate items, and are exclusive of the aid formerly, but not now, extended for the work, by the detail of officers of the army and navy.

*Estimates in detail.*

For general expenses of all the sections, namely, rent, fuel, materials for drawing, engraving, and printing, and for ruling forms, binding, transportation of instruments, maps, and charts; for miscellaneous office expenses, and for the purchase of new instruments, books, maps, and charts ..... \$19,000.

SECTION I. *Coast of Maine, New Hampshire, Massachusetts, and Rhode Island.* FIELD-WORK.—

To continue the triangulation of *Passamaquoddy bay*, and extend it so as to include the north-eastern boundary along the *St. Croix river*; to complete the secondary triangulation of the coast of Maine in the vicinity of *Mount Desert island*; to continue that of the *Penobscot river*; to continue the topography of *Passamaquoddy bay* and its dependencies; to complete that of *Prospect harbor*, and commence that of *Goldsborough bay*, (coast of Maine;) to continue that of the islands at the entrance of *Penobscot bay*, and the western shore of the bay above *Camden*; that of *St. George's river* and the adjacent shores of *Muscongus sound*; to complete the topography of the eastern shore of the *Sheepscot river*, and continue the survey of the eastern shores of *Casco bay*; to continue the detailed survey of the shores and islands of *Narragansett bay*; to continue off-shore soundings along the coast of Maine, and the hydrography of *Passamaquoddy bay*, *Frenchman's bay*, the approaches of *Penobscot bay*, and *Goldsborough* and *Prospect harbors*; to continue tidal and magnetic observations at *Eastport*, and tidal observations in the progress of the hydrography. OFFICE-WORK.—To make the computations required for, and reductions from the field observations; to commence the drawing of coast chart No. 1, *Passamaquoddy bay*; to continue the drawing and commence the engraving of coast chart No. 6, *approaches of Penobscot bay*; to continue the drawing and engraving of coast chart No. 7, *approaches to Muscongus bay and Kennebec river*, and coast chart No. 8, *approaches to Casco bay*; to continue the drawing of No. 9, coast of Maine, New Hampshire, and Massachusetts, from *Kennebunkport* to *Cape Ann*, and the drawing and engraving of No. 10, coast of Massachusetts, from *Cape Ann* to *Plymouth*, and of No. 14, *Narragansett bay, R. I., and approaches*; to continue the drawing and commence the engraving of general coast chart No. I, *Quoddy Head, Me., to Cape Cod., Mass.*, and complete the drawing and engraving of No. II, *Cape Ann to Gay Head*; to complete the drawing and commence the engraving of charts of *Eastport harbor, Me., and Rockland harbor*; to continue the drawing and commence the engraving of a chart of the *Damariscotta river*; to commence the drawing and engraving of charts of *Winter harbor, Rockport harbor, and Tennant's harbor*; and to complete the drawing and engraving of charts of the *Kennebec and Sheepscot rivers, Me.; of Newport harbor, and of Bristol harbor, R. I.*, will require.....

61,000

SECTION II. *Coast of Connecticut, New York, New Jersey, Pennsylvania, and part of Delaware.*

FIELD-WORK.—To complete the observations required for connecting the *Epping base*, in section I, with the *Fire Island base*, in section II; to continue the triangulation of *Connecticut river*, between *Higganum* and *Hartford*, and that of the *Thames river*, above *New London*; to continue verification work on the coast of *New Jersey*, south of *Manasquam inlet*; to continue the

topography of the shores of the *Connecticut* and *Thames rivers*, and the detailed survey of the shores of the *Hudson*, above the mouth of Croton river; to make a resurvey of *Absecom inlet*, and execute such supplementary hydrography as may be required in *New York bay* and *Delaware bay*; to continue the tidal observations. OFFICE-WORK.—To make the computations and reductions; to continue the engraving of coast chart No. 21, *New York harbor*, and its approaches, (new edition;) to continue the drawing and engraving of *sheets Nos. 2 and 3*, of the chart of *Hudson river*, (from Haverstraw to Glasco;) continue the drawing and commence the engraving of *sheet No. 4*, (Glasco to Coxsackie;) and commence the drawing and engraving of *sheet No. 5*, (Coxsackie northward to Troy, N. Y.;) to commence the drawing and engraving of a chart of the *Connecticut river*, and one of the resurvey of *Absecom inlet*, N. J.; and to complete the engraving of coast chart No. 28, from Cape May, N. J., to Isle of Wight, Del., will require.....

\$17,500

SECTION III. *Coast of part of Delaware and that of Maryland, and part of Virginia.* FIELD-WORK.—To continue astronomical and magnetic observations in the section, and secure the stations of the triangulation; to make extensions of the triangulation for including the detached plane-table surveys in the vicinity of *Washington city*; to complete the topography near *Baltimore* and *Washington*, required for defensive purposes, and continue that of the eastern shore of Virginia; to make such detailed surveys as may be necessary at points on the *Potomac* and *Rappahannock rivers*; and to continue the off-shore hydrography and tidal observations in the section. OFFICE-WORK.—To make the computations from field-work; to continue the engraving of coast chart No. 29, (from Isle of Wight, Del., to Chincoteague, Va.,) and the drawing of No. 30, (from Chincoteague to Great Machipongo inlet, Va.,) to commence the engraving of that chart; and to continue the drawing and engraving of coast chart No. 30, bis., (Chesapeake entrance,) and *general coast chart* No. IV (approaches to Delaware and Chesapeake bays) will require.....

13,500

SECTION IV. *Coast of part of Virginia and part of North Carolina.* FIELD-WORK.—To complete, if practicable, the primary triangulation of *Pamplico sound*, and make the requisite magnetic observations; to complete the triangulation of *Neuse river*, and take up that of *Pamplico river*; to continue the topography about *Newbern*, and the survey of the shores of *Neuse river*; to complete the topography of the outer coast of *North Carolina*, between Hatteras inlet and Core sound; to continue the in-shore and off-shore hydrography in the vicinity of *Cape Lookout*; and to execute that of *Neuse river*, and such other soundings as may be required in the waters of *Pamplico* or *Albemarle sounds*; to make observations of the tides and currents, and in the *Gulf stream*. OFFICE-WORK.—To make the computations and reductions; to continue the engraving of coast chart No. 38, (from Currituck, Va., to New inlet, N. C.,) and of No. 48, (from Barren inlet to Lockwood's Folly inlet, N. C.,) to commence the engraving of charts Nos. 46 and 47, (from Cape Lookout to Barren inlet,) and the drawing and engraving of a chart of the *Neuse river*, will require.....

15,000

SECTION V. *Coast of part of North Carolina and that of South Carolina and Georgia.* FIELD-WORK.—To execute such triangulation and topography as may be practicable in places not yet embraced in the survey; to execute the hydrography that may be required, and additional soundings in the shifting bars in this section, with tidal observations. OFFICE-WORK.—To complete the drawing and continue the engraving of coast chart No. 53, (from Rattlesnake shoal to St. Helena sound, S. C.,) to continue the drawing and engraving of No. 54, (from Fripp's inlet, S. C., to Osabaw sound, Ga.,) to continue the drawing of No. 57, (from Sapelo sound to St. Andrew's sound, Ga.,) and that of *general coast chart* No. VII, (from Winyah bay, S. C., to St. John's river, Fla.,) and commence the engraving of the last-named chart; to complete the drawing and engraving for a chart of the resurvey of *Charleston bar*, and the drawing of that of *Wassaw sound, Ga.*, will require.....

16,000

SECTION VI. *Coast, keys, and reefs of Florida.*—(See estimates of appropriation for those special objects.)

SECTIONS VII, VIII, AND IX. *Part of the western and northern coast of Florida, and the coasts of Alabama, Mississippi, Louisiana, and Texas.* FIELD-WORK.—To execute such triangulation, topography, and hydrography, in continuation of the surveys in these sections, as may

be practicable, and such special surveys as may be required for public service. OFFICE-WORK.—To continue the computations and reductions of previous field-work; to continue the engraving of *coast charts* Nos. 84 and 85, (western coast of Florida, from Ocilla river to Cape St. Blas;) the drawing of No. 96 (delta of the Mississippi) and that of *general coast chart* No. XIV, (northeastern coast of the Gulf of Mexico;) to commence the engraving of the last-named chart, and to continue the drawing of *general coast chart* No. XVI, (western coast of the Gulf of Mexico,) will require..... \$36,000

Total for the Atlantic coast and Gulf of Mexico..... 178,000

The estimates for the Florida coast, keys, and reefs, and for the western coast of the United States, (California, Oregon, and Washington Territory,) are intended to provide for the following purposes:

SECTION VI. *Coast, keys, and reefs of Florida.* FIELD-WORK.—To continue, if practicable, the survey of the eastern coast of the peninsula south of the present limit at *Matanzas inlet*, or north of *Indian river*; to complete the triangulation of keys inside of the *Florida reefs*, and between *Chatham bay* and *Cape Sable*; to continue the topography of those in *Chatham bay*, and the topography of *Charlotte harbor*; to complete the hydrography of the approaches to that harbor, and run off-shore lines of soundings from the reef and from the coast of this section; to continue magnetic observations at *Key West*, and such tidal observations as may be requisite. OFFICE-WORK.—To compute the results of field-work; to continue the drawing and engraving of *coast charts* Nos. 69 and 70, (Florida reefs, from Garden key to Big Pine key,) and *general coast chart* No. X, (Florida reefs, from Key Biscayne to the Marquesas;) and to continue the drawing and engraving of a chart of the approaches to Charlotte harbor, will require..... \$11,000

SECTION X. *Coast of California.* FIELD-WORK.—To continue the coast triangulation southward to the *San Pedro* base, or northward of *Santa Barbara*, and the work for connecting the *Santa Barbara* islands by triangulation with the coast of California; to continue the triangulation northward from *Bodega*; to continue the topography of the islands in *Santa Barbara channel*, and that of the shore of *Bahia Ona*; to complete that of *Half-moon bay*; to complete the in-shore hydrography in the vicinity of *Half-moon bay*, below San Francisco entrance; to run off-shore lines of soundings from the principal headlands of the section; to extend the in-shore hydrography northward of *Bodega*, and re-examine bars subject to change in *San Pablo bay*; to continue tidal observations at *San Diego* and *San Francisco*. OFFICE-WORK.—To make the computations from field-work; to complete the drawing and engraving of a chart of *Bodega bay*; the engraving of that of *Tomales bay*, and of the upper sheet of *San Francisco bay*; to continue the drawing of *general coast chart* of the *Pacific*, (from San Diego to Point Conception,) and commence the engraving of the same; to continue the drawing and engraving of a chart of *San Francisco bay*, to be issued in one sheet.

Also, for the operations in—

SECTION XI. *Coast of Oregon and that of Washington Territory.* FIELD-WORK.—To make the astronomical and magnetic observations required in this section, or in Section X; to continue the triangulation of *Washington sound* in connexion with former work, and to make such plane-table surveys in continuation of previous work as may be practicable; to continue the hydrography in *Admiralty inlet*, or execute soundings in special localities of Oregon or Washington Territories, as may be called for by public interests; to continue tidal observations at *Astoria*, and make such as may be required by the hydrography. OFFICE-WORK.—To continue the computations of field-work; to continue the drawing and engraving of a chart of *Washington sound*, W. T.; to continue the drawing and engraving of surveys, as far as now made, for a chart of *Admiralty inlet* and *Puget's sound*, and for the chart of *Gray's harbor*; and to add to the general chart of the Pacific coast the soundings made off *Port Orford* and *Cape Blanco*, will require..... 100,000

The three small items following are in terms and amount the same as were asked for last year:

For publishing the observations made in the progress of the survey of the coast of the United States, per act of March 3, 1843..... \$4,000  
For repairs of steamers and sailing schooners used in the survey, per act of March 2, 1853..... 4,000  
For pay and rations of engineers for four steamers to be used in the hydrography of the Coast Survey, and no longer supplied by the Navy Department..... 9,000

The amounts thus estimated for the fiscal year 1864-'65, and the appropriations for the present year, are here given in parallel columns.

Object.	Estimates for fiscal year 1864-'65.	Appropriated for fiscal year 1863-'64.
For survey of the Atlantic and Gulf coasts of the United States, including compensation of civilians engaged in the work, per act of March 3, 1843.....	\$178,000	\$178,000
For continuing the survey of the western coast of the United States, including compensation of civilians engaged in the work, per act of September 30, 1850.....	100,000	100,000
For continuing the survey of the Florida reefs and keys, including compensation of civilians engaged in the work, per act of March 3, 1849.....	11,000	11,000
For publishing the observations made in the progress of the survey of the coast of the United States, including compensation of civilians engaged in the work, per act of March 3, 1843.....	4,000	4,000
For repairs of steamers and sailing schooners used in the survey, per act of March 2, 1853..	4,000	4,000
For pay and rations of engineers for four steamers used in the hydrography of the Coast Survey, no longer supplied by the Navy Department.....	*9,000	*9,000
Total.....	306,000	306,000

\*Formerly included in estimates of Navy Department.

#### DEVELOPMENTS AND DISCOVERIES.

Closer research than would be probably required for the in-shore hydrography of any part of the Atlantic coast south of New England, has developed the positions of a number of rocks near the approaches to Portland harbor. These, with other determinations of the same kind, are referred to below in geographical order. The general list of developments and discoveries, made in the progress of the hydrography in previous years, is given in Appendix No. 4. Those for the present year are as follows:

1. The examination of the channels leading into Carver's harbor, (Penobscot bay,) with reference to the positions of rocks and shoals dangerous to navigation.
2. A dangerous ledge, determined in position, with only eleven feet at mean low water, two miles west of the north end of Metinic island, mouth of Penobscot bay.
3. Determination in position and depth of ten rocks near the approaches of Portland harbor, and of a spot with only fourteen feet water on Bulwark shoal; on Witch rock, twenty-four; on Corwin rock, twenty-four and a half; on Mitchel rock, thirty-one; on Willard rock, thirty-one and a half; on Bache rock, thirty-two feet; on Round rock, thirty feet; on Old Anthony, or Vapor rock, twenty feet; on the Western Hue-and-Cry, twenty-seven and a half feet; on West Cod ledge, thirty-four feet; and on East Cod ledge, forty-nine feet.
4. Several dangerous rocks and ledges developed in the approaches of Sippican harbor, (Buzzard's bay,) and others inside of the harbor.
5. Development of a ledge, (Great Eastern ledge,) off Montauk Point, having at one point only twenty-four feet at mean low water, and at another twenty-seven feet.
6. Development of shore-line and hydrographic changes at Sandy Hook, with reference to the effect of the great storm of January, 1863.
7. The alteration of shore-line and sea encroachment near Absecom light-house, coast of New Jersey.
8. Development of hydrographic changes at the Delaware breakwater.
9. Special survey of part of League island, Delaware river, and comparison of changes with previous surveys.
10. Examination of soundings eastward of Winter Quarter shoal, to determine the alleged existence of a second shoal.
11. A shoal found with only fourteen feet of water, S. by E.  $\frac{1}{2}$  E., and distant ten and a half miles from Cape Lookout light-house.
12. Development in position of the point, with only twenty-one feet at mean low water, of Noonday

rock, (called also Fanny shoal,) in the track of vessels passing the North Farrallon, approaching San Francisco bay.

13. Determination of the position of the wreck of the ship Flying Dragon, in the track of vessels navigating San Francisco bay.

## SPECIAL SURVEYS.

1. The surveys of Boston harbor, under the United States commissioners, and at the expense of the city, have made good progress, the resurvey of the outer barbor having been completed by Mr. Boschke and his assistants, and the survey of the South bay being now in hand. The subject of drainage of the city and districts adjacent has been investigated, with results which will lay the foundation of an excellent system. The maps are now drawing by Mr. Boschke.

Assistant Henry Mitchell has completed his useful series of experiments on tides and currents in the upper harbor of Boston, and has continued his investigations in Fort Point channel and South bay.

2. Assistant Henry L. Whiting made special examinations, for the United States engineer department, of several islands and sites along the coast, from Rhode Island to Maryland, and a report, all of which was acceptable to the chief engineer.

3. Resurveys, including the shore-line and hydrography of the vicinity of Sandy Hook, were made; the former, by Assistant H. L. Whiting, in November and December, 1862, and the latter by Assistant Henry Mitchell, in June and July of the present year, the great storm of January last having inundated a considerable part of the surface of the hook. The hydrographic resurvey embraced the False Hook channel north of the Oil spot, and about a mile and a half of the main ship channel abreast of the hook, including also Flynn's knoll and soundings along the western side of the hook.

4. An examination was made by Lieutenant Commander Phelps, United States navy, commanding the steamer Corwin, at the request of the pilot commissioners, to ascertain whether the material from the dredging of the slips at New York had caused any changes in the main ship channel.

5. A special survey of Absecon inlet, on the shore of New Jersey, has been commenced at the request of the president of the Atlantic Railroad Company, and in reference also to the safety of the light-house at Absecon inlet, which the changes of the entrance were supposed to have, perhaps, endangered.

6. By request of the United States chief engineer a resurvey of the Delaware Breakwater harbor has been made, and the chart has been furnished to the engineer department. A few changes in the depth of water were found. These, though not sufficient to alter the character of the harbor, may be of great importance in regard to the permanent condition of the breakwater itself.

7. The upper part of League island, in the Delaware, was surveyed for purposes of comparison last winter, and the channel which passes behind it sounded at the request of the Navy Department.

8. A special reconnaissance of the approaches to the city of Philadelphia has been made, with the approval of the Secretary of the Treasury, on the north side of the city, from the Delaware to the Schuylkill, by Assistant George Davidson, of the Coast Survey, and on the west side, from the Schuylkill, near Conshohocken, to the mouth of the river, by Assistant H. L. Whiting. A portion of the latter district, from the Falls of Schuylkill to Fort Mifflin, near the river bank, was examined by Assistant R. M. Bache, who also planned and erected several small redoubts and batteries, aided by Mr. R. E. McMath. Assistant C. O. Boutelle also planned an earthwork near Hestonville. Mr. Whiting was assisted by Mr. E. Hergesheimer and Mr. W. B. McMurtrie, of the Coast Survey, and by Strickland Kneass, esquire, city engineer, W. C. Gatzmer and Mr. Emerson, civil volunteers; Assistant Davidson, by Messrs. S. C. Ford, Jesse Lightfoot, J. B. Tyson, James Rowland, J. F. Wolf, D. H. Shedaker, James Reilly, J. P. Davis, Andrew French, Joseph Mercer, J. M. Seads, Alfred Young, C. McDonald, R. McCaffrey, Henry Stout, W. C. Cleveland, T. Guilford Smith, Chauncey Ives, Edward Sloan, T. R. Stocket, J. B. Atkinson, W. G. Neilson, E. D. Hallowell, Captain J. B. Williams, Charles Perkins, James Steele, Wm. T. Gummey, W. E. Weber, B. H. Smith, Edward T. Hyatt, L. R. Walton, Professor George Franck, of the Polytechnic College, J. F. Clarke, A. L. Kern, H. McIntyre, G. S. Bethel, S. Brandies, W. H. Bennett, W. C. Gatzmer, L. H. Steele, and W. H. Clarke. Mr. A. R. Fauntleroy, of the Coast Survey, assisted Mr. Davidson throughout the working season. Assistants C. M. Bache and P. C. F. West, and Sub-Assistants J. S. Bradford and Cleveland Rockwell, were here engaged during part of the season. Assistant Boutelle was aided by James F. McCabe, and Assistant R. M. Bache, by R. E. McMath, of the Coast Survey, and by Captain C. H. Gibson, second cavalry, Captain H. C. Ulman, Mr. J. W. Walker, Captain B. H. Smith, Mr. Charles Perkins, and Mr. H.

McIntyre. Sub-Assistant R. E. Halter made a survey along the Schuylkill, near Fairmount, connecting with another made by Mr. Edwin Hergesheimer, of the drawing division of the Coast Survey Office. Mr. Hergesheimer was aided by Mr. W. E. Weber. I was in charge of the surveys and works under the general direction of the mayor and Committee of Defence of the councils of Philadelphia; first under General N. J. T. Dana, major general commanding the post under Major General Couch, commanding the military department, and next under Major General George Cadwalader. To both of these officers I feel much indebted for their interest in the matter, and for their courtesy to me personally, and to my assistants, and their kind aid rendered on every occasion.

#### TIDE TABLES FOR MARINERS.—TIDES AND CURRENTS.

The tide tables for the use of mariners are contained in Appendix No. 12. Eastport, Maine, has been added to the list of stations given in Table I.

Tidal observations have been continued at four regular stations on the Atlantic coast, but have not been resumed at either of the stations of the coast now under blockade. From the officer who is now provost marshal at Brashear City, Louisiana, it has been ascertained that the tide-gauge which was delivered to his predecessor, and who had advised us of the delivery, cannot now be found. The probable conclusion is, that the instrument was destroyed or carried off in the summer, when that post was temporarily in possession of the enemy, whose advance was made soon after the provost marshal had been requested to forward the instrument to Washington.

Some special remarks on the character of the currents of New York harbor will be found in the second part of the report, under the head of Section II.

#### INFORMATION FURNISHED.

The information furnished from the office in reply to special calls, and generally in the form of tracings from the original sheets of the survey, is stated in the form of a list in Appendix No. 2.

Since the commencement of the rebellion, much the larger part of the matter so furnished has been for the use of the army and navy. The applications from civil life are complied with under the sanction of the Treasury Department, and on the condition that due credit is given to the government in any publication of the material obtained from the office.

#### STATISTICS.

The table of statistics has been added to so as to bring it up to the present surveying year, and is given in Appendix No. 3.

Up to 1862, inclusive, the triangulation has covered an area of about sixty-two thousand six hundred square miles, extending along a general coast-line of nearly forty-seven hundred miles, and developing a shore-line, reckoning the river indentations, of twenty-four thousand miles, by the determination of nine thousand nine hundred geographical positions.

For latitude observations one hundred and twenty-nine stations have been occupied, for longitude eighty-five, and for azimuth eighty-six stations.

The topography had extended over an area of seventeen thousand three hundred square miles, having a general coast-line of forty-two hundred miles, and a shore-line of over forty-three thousand three hundred.

The hydrography extended over an area estimated at forty-six thousand five hundred square miles, in which nearly two hundred and five thousand miles were run in sounding, six million seven hundred and eighty-four thousand casts of the lead were taken, and over eighty-four hundred specimens of bottom collected.

The number of manuscript maps and charts was twenty-two hundred and seventy-four, and of engraved maps, charts, and sketches, five hundred and seven. The combination of several for publication in one sheet, and transfer of material for new editions, have considerably lessened this aggregate of the engraved plates.

#### TOPOGRAPHICAL AND HYDROGRAPHIC SHEETS.

The titles of the topographical and hydrographic sheets registered at the office since 1861 are given in Appendix Nos. 15 and 16. Of the entire number seventy-one are plane-table sheets, and sixty-one are original hydrographic charts. The list containing the titles is in continuation of previous ones which have been published with my report biennially since 1857. The scale of each survey is stated in the lists.

## PLEIADES COMPUTATIONS.

During the past year the ephemerides of the moon for all the occultations of the Pleiades, from 1838 to 1842, have been completed by Professor Benjamin Peirce, and verified by a duplicate computation by Mr. C. S. Peirce.

The remainder of the work has also been completed for three occultations, those of April 13, 1842, of January 21, 1842, and of September 6, 1841.

All the other occultations will be finished in the course of the coming year, at the rate of about one in a month.

The report of Professor Peirce, on the occultations of 1841-'42, is given in the Appendix, (No. 17.)

A part of the computations connected with the method of determining longitude by occultations of the Pleiades has been made in the office, under the charge of Assistant Schott, two computers being so engaged since the 1st of November. The series undertaken comprise the observations made between the beginning of the year 1856 and the end of 1861, and are to be reduced according to the plan laid out by Professor Peirce, and under his supervision. The necessary revisions are made by the chief of the computing division.

## COMPUTATIONS OF LONGITUDES.

The computation of the longitudes obtained by telegraph observations has been continued by Dr. Gould through the last year. The longitudes of seven places have been deduced from observations made at stations on the line Wilmington—New Orleans. The details of results are given in Appendix No. 18.

A curious series of facts in regard to a diurnal movement in azimuth, of the transit instrument, was noticed in Dr. Gould's last report, and is discussed in his report for this year. The labor expended on the determinations of right ascensions appears fully justified by the observations of the past year, in which these results were used. The preparation of a list of declinations for the time stars has made considerable progress.

## MAGNETISM.

The series of papers on the results of the discussion of magnetic observations made at Girard College, Philadelphia, from 1840 to 1845, and now being published by the Smithsonian Institution, is continued this year by the insertion of Parts VII, VIII, and IX, which contain the investigation of the vertical component of the magnetic force. As these discussions are very similar to those of the horizontal component given last year in Parts IV and V, but little additional explanation is needed in regard to their method.

Part VII commences with the discussion of the effect of temperature upon the readings of the magnetometer, and the reduction of the observations to a uniform temperature, (66° Fahrenheit,) and then the progressive and apparently irregular changes in the readings of the instrument are inquired into. Peirce's criterion was applied, as in the former papers, for the recognition and separation of the disturbances. The limit found was thirty scale divisions. The existence of the eleven-year period, in the amplitude of the diurnal variation of the vertical force, is proved, and the force found greatest between 1 p. m. and 2 p. m., and least between 8½ p. m. and 10½ p. m. The investigation proceeds with a general analysis of the disturbances, showing their dependence in number and amount on the eleven-year period. Their annual and diurnal inequality are also shown. The months of greatest disturbance are March and September, the least disturbance being in June. The greatest number of disturbances occurs about 1 a. m., and the least number at 10 a. m. There is, however, a secondary period in each case. In these inquiries, the disturbances which increase the force, and those which diminish it, are separately examined. The paper concludes with a classification of the disturbances according to their magnitude.

To this paper is added a discussion of the effect of the brighter auroras upon the magnetic declination, and upon the horizontal and vertical forces. Each account of an aurora is specially collated with the corresponding observations of the magnetic elements. The apparent effect of the aurora upon each of the magnetic elements is stated in tabular form.

Part VIII treats of the solar diurnal variation, and of the annual inequality of the vertical force; also, of the semi-annual inequality of the diurnal variation, and of the diurnal range of the same. The greatest diurnal variation occurs about 1½ p. m., and the least about 10 p. m. with indications of a secondary maximum and minimum. At 5½ a. m. and 7 p. m. there is no change in the diurnal variation throughout the year. The force also appears to be greatest in May, June, July, and August. The results are expressed in part analytically, and in part graphically.

The full papers will be found in the Appendix Nos. 19, 20, and 21, and the illustrative diagrams in Sketch No. 30.

Part IX contains the investigation of the lunar influence upon the vertical force, and on the inclination and total force. The method of investigation being precisely the same as that pursued in the investigation for the horizontal force, no further explanation is here required. In tracing out the lunar effect upon the vertical force, we have to contend with greater irregularities than were experienced in the preceding case of the other component, a large share of which is probably due to the great temperature reductions required for the magnet. In all, 19,513 observations have been discussed and arranged for inquiry, 9,719 belonging to western, and 9,794 to eastern hour angles of the moon. A separation of the results for winter and summer season was found impracticable owing to the shortness of the whole series. The lunar diurnal variation, presented analytically and graphically, shows a double crested curve, with a principal maximum a little before the upper culmination, and a principal minimum, about  $3\frac{1}{2}$  hours after the lower culmination of the moon; the average epoch of the vertical force tide is, therefore, about  $1\frac{1}{2}$  hour apparently in advance of the culminations. The secondary wave is very feeble, its greatest value happens about nine hours, western hour angle, and its least value about three hours before, giving a range of nearly a tenth part of the principal range, which is 0.000027 parts of the force. The subject of the epochs of the lunar diurnal variation is yet very imperfectly brought out, and more observations are desirable. The Toronto and Philadelphia curves are also examined and their accordances or differences stated.

The lunar effect upon the inclination and total force is obtained by a proper combination of the horizontal and vertical components of the force. For the inclination we have maxima at  $8\lambda$ . and  $20\lambda$ . (principal;) minima at  $3\lambda$ . (principal) and  $13\frac{1}{2}\lambda$ .; total range,  $3''6$ . The Philadelphia and Toronto curves are remarkably accordant. For the total force we have maxima at  $\frac{1}{2}\lambda$ . (principal) and  $11\lambda$ . minima at  $7\frac{1}{2}\lambda$ . and  $17\lambda$ . (principal;) total range, 0.000026 parts of the force.

The ordinary observations for the determination of the magnetic elements along our eastern Atlantic coast have been prosecuted by Assistant Charles A. Schott, who occupied nine stations in July last. Assistant G. W. Dean also observed at two of the primary stations. The results found are presented in Appendix No. 22.

Observations have been continued at Eastport, Maine, and at Key West, Florida. As heretofore the observations are made near the middle of each month of the year for the magnetic declination, dip, and intensity. At Key West, in addition to these, a continuous record of the three magnetic elements is kept up by photographic self-registering instruments.

At the request of the Navy Department observations were instituted last spring, by a committee of the National Academy of Science, on the deviation of compasses on iron and iron-clad vessels in the government service.

The following is a brief account of work done under my immediate direction for the compass committee since June last. Four magnetic surveys were made of two vessels, viz: of the United States steamer *Roanoke*, (iron plated and turreted,) and of the Ericsson battery *Passaic*, (iron vessel with turret.) Another vessel, the *Monadnock*, was also visited, but was only partially examined, as only part of the armor was in place. Four reports have been submitted by Assistant Charles A. Schott, to whom this work was intrusted. The special points embraced in the reports are the following: First, the local deflections of the needle on board of the *Roanoke* (at the Brooklyn navy yard) were ascertained at nine stations of equal elevation above deck, and a curve of no deviation was located. Some experiments were made as to the height above deck and above turret, at which the local deflection would disappear. At the same deck stations the horizontal magnetic force was measured, also the total force, both in connexion with the same elements at a shore station. The distribution of magnetic polarity on the outer and inner surface of the turrets (gun and steering turrets) was traced out graphically.

The second paper reports on the compasses of the *Roanoke* compared in two opposite headings of the vessel, additional observations having been made as to the extent in altitude of the local deviations. The heading of the vessel being opposite, a new set of observations of deflections at the deck stations was made, also a re-examination of the polarity of the turrets. The experiments for relative horizontal and total intensity were extended to the ship's cabin, and to the interior of the turrets. The magnetism of armor plates, some in situ, and others in the yard of Mr. Webb, intended for the "*Dunderberg*," was examined.

The third report treats of experiments and investigations which were made on the "*Passaic*," similar to those above stated. These include the polarity of the turrets, and of side armor, the horizontal, and total force below and above deck, and within the turret; also the local deflection of the compass together with

notes on the polarity of the plating of the "Monadnock," at the Charlestown navy yard. Some experiments on the polarity of iron were included.

In the fourth report the results are stated of experiments for the local deflection of the compass at various headings of the "Roanoke," when lying in James river, Virginia, in November. By means of a standard azimuth compass mounted on deck, the deviation of which had been determined, simultaneous readings were taken on four other compasses. The deviations of the latter being thus determined were tabulated, and steering tables were made out. These results were also shown graphically. A design for mounting and using compasses on board of turreted iron-clads was also submitted.

#### EXPERIMENTAL INQUIRIES.

Careful experiments were made in the early part of the present year by Assistant George W. Dean, at the office of the Coast Survey, on two forms of the relay magnets used in long telegraph lines to repeat the signals, which led him to the conclusion that the scientific principles involved in the construction of the instrument had not been sufficiently considered. In one set of instruments the time lost by breaking the circuit ("induction time") varied from 0.02 of a second to 0.06 of a second, while in another the time lost varied from 0.06 to 0.016 of a second. These variations would be encountered in using relay magnets in determinations of differences of longitude. The subject is still under discussion experimentally, by Mr. Dean, who has the kind advice of Professor Henry in the improvement of the construction of the instruments, and the assistance of the best mechanicians who are occupied in such work. Mr. Dean's report on the experiments is given in Appendix No. 23.

The globe lens of Messrs. Harrison and Schnitzer has been found, by trial at the office, well adapted to photographic purposes. A report by the assistant in charge of the office, J. E. Hilgard, esq., on the tests to which it was subjected before its adoption for our use, will be found in the Appendix, No. 24.

#### SAXTON'S HYDROMETER.

This instrument, intended to replace the ordinary hydrometer in the test of the strength of alcoholic liquids, the importance of which has been very much increased by the new tariff and revenue laws, has been invented by Joseph Saxton, esq., of the Office of Weights and Measures. It is thus described by Professor J. F. Frazer, the chairman of the committee of the National Academy of Sciences, to whom it was referred by the Office of Weights and Measures for examination: "The instrument consists of a glass bulb of a spheroidal form, to which is attached a chain of one hundred links, which are smaller in proportion as they are nearer to the lower end of the chain. For the sake of convenience in reading, each tenth link is of a different form from the others. The instrument is so graduated that, in pure water, at the normal temperature of 60° Fahrenheit, it floats entirely immersed, and carrying suspended its whole chain; whilst in absolute alcohol, at the same temperature, the bulb alone floats, the whole chain lying on the bottom of the vessel. Each link of the chain is made of such weight that the number lying on the bottom in any given mixture of alcohol and water, at the normal temperature, represents the percentage of alcohol in that mixture. Should the liquor be at any other temperature, the ordinary tables will suffice for the reduction of the apparent to the true strength."

The committee, consisting of Professor Frazer, General Totten, Dr. Barnard, and Chancellor Chauvenet, after a close and critical examination of the instrument, recommended its use by the government in place of the alcoholometer now used.

#### AIDS TO NAVIGATION.

The recommendations of assistants working on various parts of the coast, in regard to buoys, deemed desirable as aids to navigation, will be found in Appendix No. 29. The list contains, in particular, the recommendations of Assistant Edwards for buoys to mark the channels into Carver's harbor, (Penobscot bay,) and those of Lieutenant Commander Phelps for the rock on which the steamer Great Eastern struck in 1862. The recommendations of that officer in regard to the buoys of the Potomac are also given, and those of other assistants in different sections of the coast.

In continuation of the work of last year, the party of Assistant Boutelle set the buoys needed at the entrance of Ossabaw sound, having rendered similar duty at all the principal entrances used by the South Atlantic blockading squadron.

#### OBITUARY.

Major E. B. Hunt, of the United States engineers, though relieved before the commencement of the

war from service on the Coast Survey, maintained a most active interest in its welfare and progress, and in the subjects embraced by or contributing to its operations. His sudden death was appalling to us, occurring as it did at the very time we were about to call upon him for services which were so much in his line that there was no doubt he would cheerfully have rendered them, had his professional duties permitted. He was occupied, indeed, to the full extent of the capabilities and physical power of an ordinary man, but his great mental activity and bodily strength made it appear as though there was no limit to his power of undertaking congenial work. As an officer of engineers, he had occupations connected with the defence of New Haven, of New London, of the western entrance into Narragansett bay, and of the city of Providence, R. I. As an experimentalist, he was engaged, under the auspices of the Navy Department, in perfecting his sea-miner or submarine projectile, for operations offensive and defensive against vessels in harbor defence.

Major E. B. Hunt was born in Allegany county, New York, in 1822, and entered the Military Academy at West Point in 1841. He graduated first in his class, and was commissioned in the corps of engineers, in which he rose to the rank of major.

The habits of study which belonged to his youth adhered to him in manhood, and the powers of his mind were always kept alive by close reading, and by original researches in mechanical and physical philosophy. General speculations were more congenial to his mind than detailed investigations, and while occupied with manifold professional duties, he was especially at home on the meetings of the American Association for the Advancement of Science, to which he contributed numerous papers. He found a congenial field of operations in the office of the Coast Survey, where he served during three years, (1851—1853,) always eager for improvement, and contributing liberally his ideas towards progress in its various departments. His love of system induced him early to propose an index of the scientific papers published throughout the world, and he had made, when the absorbing duties of the war took him to other fields of labor, considerable progress in a special index for the subjects embraced in this work. The extensive plan matured by the Royal Society at the suggestion of the Smithsonian Institution of the United States, and of the British Association for the Promotion of Science, had rendered this work comparatively of little moment, and I suppose Major Hunt had yielded, though with reluctance, to this necessity of the case. Classification was such a favorite mental occupation with him that he was tolerant of labor which is generally found to be disgusting to men of his mental calibre and success in original investigation. It may truly be said of Major Hunt that he never changed his place or opportunity of observation without producing something on the facts, relations, and causes of things observed. This general habit of investigation won for him the acquaintance of a large circle of scientific men who have shown their appreciation of his mental culture and original thought by the expressions of their profound regret at his decease. The melancholy termination of a distinguished career is thus stated on the authority of Colonel Richard Delafield, of the corps of engineers, by Professor Alexander C. Twining, who attended, as a delegate from the Connecticut Academy of Sciences, the funeral of Major Hunt, at West Point, on the 5th of October, 1863, a few days after he had breathed his last at the New York navy yard.

"Major Hunt was practicing, at a place about five miles below the navy yard at Brooklyn, in experiments upon his new invention for breaking through the armor of iron-plated ships. His gun had just been fired from the upper deck—being itself on the deck beneath. Perceiving an effect that was wrong, Major Hunt passed part way down a ladder into the apartment below, but soon made his way back and lifted his hand for help. The fact appears to have been that the missile had been thrown backward, instead of forward, out of the gun, and the gun-room, from which the experimenter was escaping, had become full of an irrespirable gas from the burning composition. The lifted hand was caught by one of the laborers on deck, but could not be held, and Major Hunt fell into the hold with his face down and immersed in water. He was followed by the laborer, who turned his face upward, but could do no more. Afterwards a fresh hand went down and fastened a rope around the body, but not securely, for in the after lifting, when partly accomplished, Major Hunt slipped through with a second fall. He was not brought up until the gas was dispersed or absorbed by water thrown down. Then he was taken to the navy yard, but in an insensible condition, and surgical aid was obtained not till then, and then in vain."

In Appendix No. 25 will be found a list of the scientific papers published by Major Hunt. A monument of his labor is in the ten-years index of the annual reports of the Coast Survey, published in the volume for 1854. It has not been reserved for him to repeat this onerous task a second time, a task for which he was probably better qualified than any other man living, and which we were about to ask him to undertake when the shock of his death came suddenly upon us.